

In a test at a frequency of 172 GHz, the amplifier was found to generate an output power of 7.5 mW, with approximately 5 dB of large-signal gain (see Figure 2). Moreover, the amplifier exhibited a peak small-signal gain of 7 dB at a frequency of 176 GHz. This performance of this MMIC single-stage amplifier containing only a single transistor represents a significant advance in the state of the art, in that it rivals the 170-GHz performance of a prior MMIC three-stage, four-transistor amplifier. [The prior amplifier was reported in "MMIC HEMT Power Amplifier for 140 to 170 GHz" (NPO-30127), *NASA Tech Briefs*, Vol. 27, No. 11 (November 2003), page 49.]

This amplifier is the first heterojunction-bipolar-transistor (HBT) amplifier built for medium power operation in this frequency band. The performance of the amplifier as measured in the aforementioned tests suggests that InP/InGaAs HBTs may be superior to high-electron-mobility (HEMT) transistors in that the HBTs may offer more gain per stage and more output power per transistor.

This work was done by Vamsi Paidi, Zack Griffith, Yun Wei, Mattias Dahlstrom, Miguel Urteaga, and Mark Rodwell of the University of California at Santa Barbara and Lorene Samoska, King Man Fung, and Erich Schlecht of Caltech for NASA's Jet

Propulsion Laboratory. Further information is contained in a TSP (see page 1).

In accordance with Public Law 96-517, the contractor has elected to retain title to this invention. Inquiries concerning rights for its commercial use should be addressed to:

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Modular, Microprocessor-Controlled Flash Lighting System

This system can be readily reconfigured to satisfy different requirements.

John H. Glenn Research Center, Cleveland, Ohio

A microprocessor-controlled lighting system generates brief, precisely timed, high-intensity flashes of light for scientific imaging at frame rates up to about 1 kHz. The system includes an array of light-emitting diodes (LEDs) that are driven in synchronism with an externally generated timing signal (for example, a timing signal generated by a video camera). The light output can be varied in peak intensity, pulse duration, pulse delay, and pulse rate, all depending on the timing signal and associated externally generated control signals.

The array of LEDs comprises as many as 16 LED panels that can be attached together. Each LED panel is a module consisting of a rectangular subarray of 10 by 20 LEDs of advanced design on a printed-circuit board in a mounting frame with a power/control connector. The LED panels are controlled by an LED control module that contains an AC-to-DC power supply, a control

board, and 8 LED-panel driver boards. In prior LED panels, the LEDs are packaged at less than maximum areal densities in bulky metal housings that reduce effective active areas. In contrast, in the present LED panels, the LEDs are packed at maximum areal density so as to afford 100-percent active area and so that when panels are joined side by side to form the array, there are no visible seams between them and the proportion of active area is still 100 percent. Each panel produces an illuminance of $\approx 5 \times 10^4$ lux at a distance of $\frac{5}{8}$ in. (≈ 1.6 cm).

The LEDs are driven according to a pulse-width-modulation control scheme that makes it safe to drive the LEDs beyond their rated steady-state currents in order to generate additional light during short periods. The drive current and the pulse-width modulation for each LED panel can be controlled independently of those of the other 15

panels. The maximum allowable duration of each pulse of drive current is a function of the amount of overdrive, the total time to be spent in overdrive operation, and the limitations of the LEDs. The system is configured to limit the overdrive according to values specific to each type of LED in the array. These values are coded into firmware to prevent inadvertent damage to the LED panels.

This work was done by Dwayne Kiefer, Elizabeth Gray, and Robert Skupinski of QSS Group, Inc. and Arthur Stachowicz and William Birchenough of Zin Technologies, Inc. for Glenn Research Center. Further information is contained in a TSP (see page 1).

Inquiries concerning rights for the commercial use of this invention should be addressed to NASA Glenn Research Center, Innovative Partnerships Office, Attn: Steve Fedor, Mail Stop 4-8, 21000 Brookpark Road, Cleveland, Ohio 44135. Refer to LEW-17894-1.